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(54) Abstract Title
Mobile communication device providing a display of the amount of data remaining from a subscribed amount

(57) A mobile communications device for use in a packet switched wireless communications network, for example GPRS, which is able to indicate an amount of data remaining 46 from a subscribed amount. This allows the user to see how much data can be sent or received within a prepaid subscription. The display may provide a graphical representation of the amount of data left. The mobile communications device may calculate the amount of data sent and received in such a way that it avoids double counting of retransmissions.

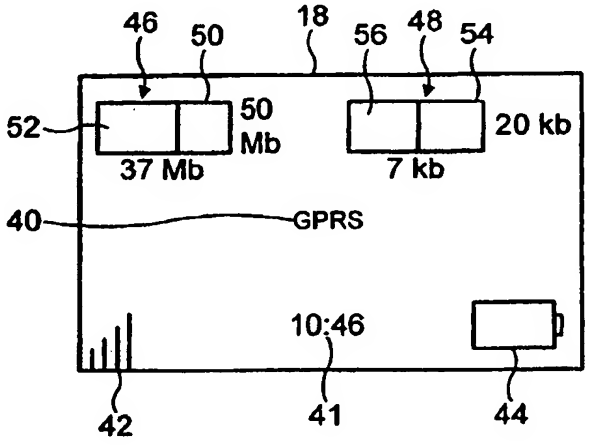

FIG. 3

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COMMUNICATIONS DEVICE

TECHNICAL FIELD OF THE INVENTION

This invention relates to a communications device, and in particular to a mobile communications device which is capable of transferring data to, and receiving data from, a wireless network. For example, the invention is applicable to handsets for use in a General Packet Radio Service (GPRS) digital cellular telecommunications system.

BACKGROUND OF THE INVENTION

In a conventional second generation mobile communications system, for example operated under the Global System for Mobile Communications (GSM), a mobile subscriber is typically charged an amount which depends on the duration of his connection to the network. In the case of a prepaid phone, a subscriber pays in advance, and receives a corresponding credit.

EP-A-1030506 shows a prepaid mobile phone, which has a display, which displays the current credit value numerically on the display of the phone.

By contrast, in a third generation mobile communications system, for example operated under the General Packet Radio Service (GPRS) digital cellular telecommunications system, it is envisaged that subscribers will advantageously be able to maintain a permanent network connection. In this case, it may be inappropriate to charge the subscriber an amount which is dependent on the duration of the connection to the network. Rather, it may be more appropriate to make a charge which is related to the amount of data exchanged between the subscriber and the network.

One possibility is that a network operator may make a basic charge, for example monthly, with the subscriber being allowed to send or receive a specified amount of data within that basic charge.

SUMMARY OF THE INVENTION

According to the present invention, there is provided a mobile communications device, which includes a display, which is able to indicate an amount of data remaining from a subscribed amount.

This allows the user to see how much data he can send or receive, within a prepaid subscription.

Preferably, the display is graphical, allowing the user to judge the amounts of data easily.

Preferably, the mobile communications device calculates the amounts of data sent and received in such a way that it avoids double counting of retransmissions. If retransmissions are not counted, this means that a user does not have to pay twice for retransmissions which may be necessitated by network faults. In order to be able to measure the amounts of data in the mobile station, while ignoring retransmissions, the mobile station makes the measurements using a protocol under which the mobile station communicates with a network node.

In a further preferred embodiment of the invention, the display of the mobile station is further able to indicate the amount of data remaining to be received or transmitted in an existing session.

In accordance with another aspect of the invention, there are provided methods of operation of a mobile communications device in accordance with the first aspect of the invention.

It should be emphasised that the term "comprises/comprising" when used in this specification is taken to specify the presence of stated features, integers, steps or components but does not preclude the presence or addition of one or more other features, integers, steps, components or groups thereof.

BRIEF DESCRIPTION OF DRAWINGS

Figure 1 shows a mobile communications device in accordance with the present invention.

Figure 2 is a block schematic diagram of the mobile communications device of Figure 1.

Figure 3 shows a display screen of the mobile communications device of Figure 1, illustrating the operation of the present invention.

Figure 4 illustrates the protocol structure by which the mobile communications device of Figure 1 communicates with a wireless network.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Figure 1 shows a mobile phone 10, which implements the present invention. Although Figure 1 shows a mobile phone, the invention is generally applicable to portable radio communication equipment or mobile radio terminals, such as mobile telephones, pagers, communicators, electronic organisers, smartphones, personal digital assistants (PDAs), or the like, in particular to such devices which can be operated in packet switched wireless communications networks.

Figure 2 is a block schematic diagram, illustrating the operational connections between the various components thereof.

Thus, the phone 10 includes an antenna 12, microphone 14, speaker 16, display 18, and keypad 20, all of which have their conventional functions.

The antenna is connected to transceiver circuitry 22, which is further connected to a processor 24. The processor 24 controls the operation of the phone 10, using appropriate software. The transceiver circuitry 22 receives incoming radio frequency signals from the antenna 12, and downconverts and demodulates them for use by the processor 24. The transceiver circuitry 22 also receives data signals from the processor 24, and

then modulates them and upconverts them to radio frequency for transmission via the antenna 12.

The microphone 14 and speaker 16 are connected to the processor 24 through a voice coder/decoder 26, which converts the signals into appropriate formats.

The phone 10 further includes a removable Subscriber Identity Module (SIM) card 28, which is a removable smart card, which stores information about the subscriber. Of particular relevance to this invention is the fact a subscriber may have a prepaid subscription, allowing him to receive or transmit a certain quantity of data in a subscription period. For example, a subscriber may pay a monthly subscription, entitling him to receive or transmit, say, 50 megabytes of data during that period. All such subscription information is stored on the SIM card 28.

The phone of Figures 1 and 2 also includes an interface 30, for connection to an external device. For example, the external device may be a portable, or laptop, computer. The interface may be wired or wireless, for example using an infrared link or using the Bluetooth short range radio link. The interface 30 can therefore allow the external device to connect to remote devices over the wireless communications network.

The display 18 may conveniently be an LCD display, suitable for displaying status information etc., or may be any other suitable type of display. Figure 3 shows the information which is provided on the display 18 in accordance with the invention.

Thus, in Figure 3, the display indicates the network to which the device is connected 40, the current time 41, the received signal strength 42 and the battery charge level 44. In addition to these conventional features, the display 18 also indicates

the remaining amount of subscribed data 46 and the remaining amount of data in a current session 48.

As is conventional, the user can scroll through various available options using the keypad 20 of the phone, and can choose whether or not to display either of the indicators 46, 48.

When the user chooses to display the indicators, they each preferably show a total amount of data and a remaining amount of data.

Thus, the indicator 46 includes a bar 50, the length of which indicates the total amount of data which the user is entitled to send or receive in a month, and also includes a numerical indication of the amount of data, namely 50 megabytes in this case. The bar 50 includes a shaded region 52, the length of which indicates the remaining amount of the subscribed amount of data. Thus, this amount is indicated graphically. The amount, namely 37 megabytes in this case is also indicated numerically.

Similarly, during a session, namely a download from the network or a transmission of a large file to the network, the indicator 48 shows the remaining amount of data in the current session. Thus, somewhat similarly to the indicator 46, the indicator 48 includes a bar 54, the length of which indicates the total amount of data to be sent or received as part of the session, and also includes a numerical indication of the amount of data, namely 20 kilobytes in this case. The bar 54 includes a shaded region 56, the length of which indicates the remaining amount of data in the session, and this amount is also indicated numerically, namely 7 kilobytes in this case.

The information about the total amount of data, which the user is entitled to send or receive in a month, is stored on the SIM card 28, and can be

retrieved by the processor 24 for supply to the display 18.

The information about the total amount of data to be sent or received as part of the session is also generally available. In the case of data to be transmitted, the size of a file can generally be read. In the case of data to be received, the size of a download can be determined from the remote device.

However, the information about the remaining amount of the subscribed amount of data must be calculated from other information. In particular, it is of course necessary to calculate the remaining amount of the subscribed amount of data by first calculating the amount of data which has been received or sent.

Figure 4 shows the transmission plane, that is, the protocol structure, in the General Packet Radio Service (GPRS) digital cellular telecommunications system, as defined at ETSI EN 301 344 GSM 03.60 version 7.4.0, page 22, section 5.6.1. Thus, this diagram shows the protocols which are used between the mobile station (MS), base station system (BSS), serving GPRS support node (SGSN) and gateway GPRS support node (GGSN).

When calculating the amount of data which has been received or sent, it is preferable to ignore header information associated with the transmitted packets of data, and to ignore retransmissions of packets. That is, the GPRS system includes mechanisms whereby, if a packet of data is not correctly received, it can be retransmitted. However, it is preferable that the subscriber should only be charged once for each packet, irrespective of the number of transmissions which may have been necessary. This will be more acceptable to the subscriber.

If the network will ignore header information, and retransmissions, when calculating the cost to the subscriber, the mobile phone should similarly ignore them when calculating the amount of data received or transmitted.

When the data is being transferred to or from an application which is running in the mobile phone itself, the amount of raw data, excluding header information and retransmissions, can be calculated in any convenient way.

However, as discussed previously, the mobile phone may advantageously be being used to connect a laptop computer to another device over the GPRS network. In that case, there is no protocol between the mobile phone and the laptop computer which allows the mobile phone to distinguish between data which is being transmitted for the first time, and retransmissions of unsuccessfully transmitted data.

Therefore, since most retransmissions are done on one of the lower layers, such as the Logical Link Control (LLC) protocol or Radio Link Control and Medium Access Control (RLC/MAC) protocols, the amount of transmitted data can most accurately be measured at the Subnetwork Dependent Convergence Protocol (SNDCP), at least when the application is running on a separate device from the mobile phone.

Since it is preferable to make the measurement at the same point whether the application is running on a separate device or on the mobile phone itself, the amount of transmitted or received data is therefore measured between the Subnetwork Dependent Convergence Protocol (SNDCP) and the Internet Protocol (IP) or X.25, whichever of these latter two protocols is being used.

That is, the mobile phone measures the number of

bits transferred from the SNDCP to the IP/X.25, in the case of incoming data, or transferred from the IP/X.25 to the SNDCP, in the case of outgoing data.

Information about the remaining amount of data in a session can be calculated in the same way as the information about the remaining amount of the subscribed amount of data, by measuring the amount of data transmitted or received to date.

In the system described above, the mobile phone measures the amount of data received and sent. However, the amount charged by the network operator to the subscriber will depend on the amount of data measured by the network itself. Information concerning the amount of data measured by the network can be sent periodically from the network to the mobile phone. The information provided by the network can then be compared in the phone with the amount measured by the phone itself, with the user being alerted in the event of any significant discrepancy. Alternatively, if the information concerning the amount of data measured by the network is sent sufficiently frequently from the network to the mobile phone, it becomes unnecessary for the phone to make any measurements, and the display can rely entirely on the information received from the network.

The description above assumes that the subscriber will be charged for all of the data transferred. However, in practice, this will not be the case. For example, data which is to be sent or received at no cost to the subscriber may have a specific flag attached thereto. If the displayed information, relating to the remaining amount of the unsubscribed data, is then to be obtained from calculations in the mobile phone, the phone will need to determine whether each transmission has that flag attached to it.

There is thus described a mechanism which allows the user to see easily how much of a subscribed amount of data is remaining.

CLAIMS

1. A mobile communications device, comprising:

a storage device, the storage device being capable of storing an indication of a first subscribed amount of data;

a display, the display being capable of providing a first visual indication of a second amount of data remaining from the subscribed amount of data.

2. A mobile communications device as claimed in claim 1, wherein the first visual indication comprises a first region of the display, having a size related to the first subscribed amount of data, and a second region of the display within the first region, having a size related to the second amount of data remaining from the subscribed amount of data.

3. A mobile communications device as claimed in claim 1 or 2, further comprising:

processing circuitry, for calculating a third amount of data transmitted and received, and for calculating the second amount of data on the basis of the calculated third amount of data.

4. A mobile communications device as claimed in claim 3, wherein the processing circuitry calculates the third amount of data transmitted and received, excluding header information.

5. A mobile communications device as claimed in claim 3 or 4, wherein the processing circuitry calculates the third amount of data transmitted and received, excluding retransmissions.

6. A mobile communications device as claimed in claim 5, wherein the processing circuitry calculates the third amount of data transmitted and received between a Subnetwork Dependent Convergence Protocol (SNDCP) and IP/X.25.

7. A mobile communications device as claimed in

any preceding claim, wherein the storage device is removable.

8. A mobile communications device as claimed in claim 7, wherein the storage device comprises a SIM card.

9. A mobile communications device as claimed in any preceding claim, wherein the processing means is further capable of calculating a fourth amount of data in a session.

10. A mobile communications device as claimed in claim 9, wherein the display is further capable of providing a second visual indication of a fifth amount of data remaining in said session.

11. A mobile communications device as claimed in claim 10, wherein the second visual indication comprises a third region of the display, having a size related to the fourth amount of data in the session, and a fourth region of the display within the third region, having a size related to the fifth amount of data remaining from the session.

12. A mobile communications device as claimed in any preceding claim, capable of obtaining information, relating to the second amount of data, from a signal received from a mobile communications network.

13. A method of operating a mobile communications device, comprising:

storing an indication of a first subscribed amount of data; and

providing a first visual indication of a second amount of data remaining from the subscribed amount of data.

14. A method as claimed in claim 13, wherein the first visual indication comprises a first region of the display, having a size related to the first subscribed amount of data, and a second region of the display

within the first region, having a size related to the second amount of data remaining from the subscribed amount of data.

15. A method as claimed in claim 13 or 14, further comprising:

calculating a third amount of data transmitted and received, and calculating the second amount of data on the basis of the calculated third amount of data.

16. A method as claimed in claim 15, comprising calculating the third amount of data transmitted and received, excluding header information.

17. A method as claimed in claim 15 or 16, comprising calculating the third amount of data transmitted and received, excluding retransmissions.

18. A method as claimed in claim 17, comprising calculating the third amount of data transmitted and received between a Subnetwork Dependent Convergence Protocol (SNDCP) and IP/X.25.

19. A method as claimed in any of claims 13 to 18, further comprising calculating a fourth amount of data in a session.

20. A mobile communications device as claimed in claim 19, further comprising providing a second visual indication of a fifth amount of data remaining in said session.

21. A method as claimed in claim 20, wherein the second visual indication comprises a third region of the display, having a size related to the fourth amount of data in the session, and a fourth region of the display within the third region, having a size related to the fifth amount of data remaining from the session.

22. A method as claimed in any of claims 13 to 21, further comprising obtaining information, relating to the second amount of data, from a signal received from a mobile communications network.

23. A mobile communications device, having a display, the display being capable of indicating an amount remaining from a subscribed amount of data.

24. A method of operating a mobile communications device, the method comprising:

providing a visual indication of an amount of data remaining from a subscribed amount of data.

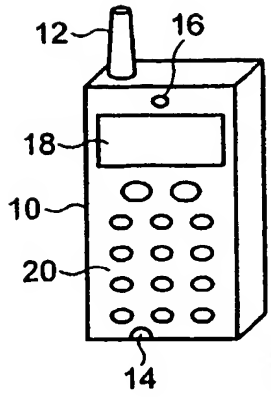

FIG. 1

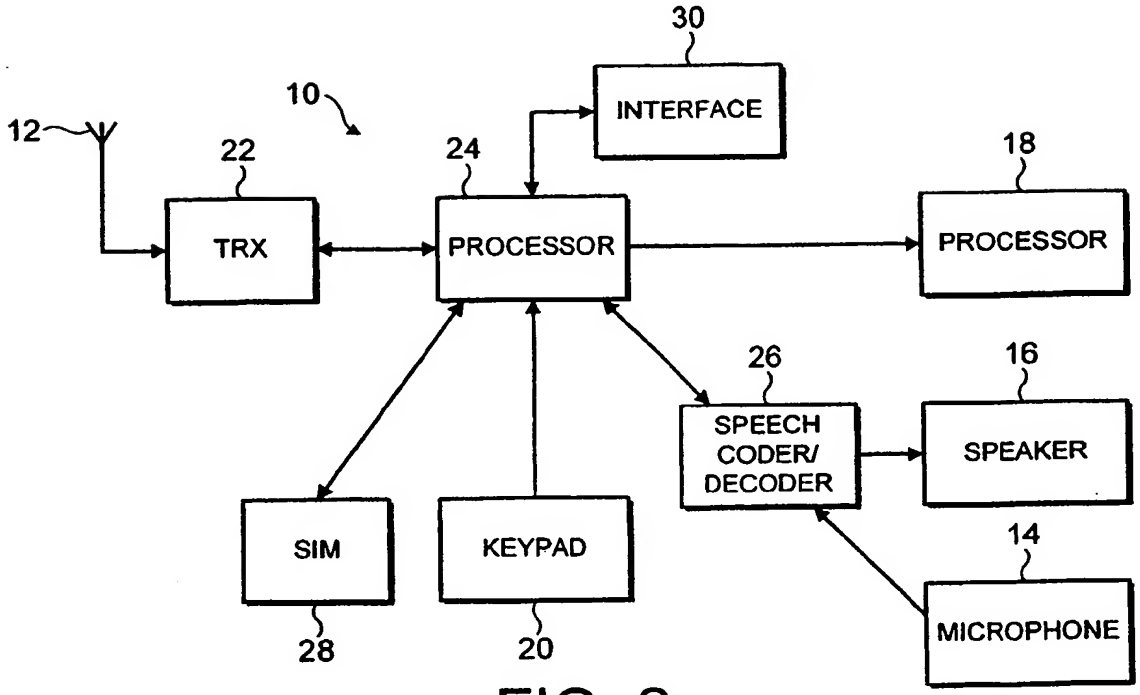

FIG. 2

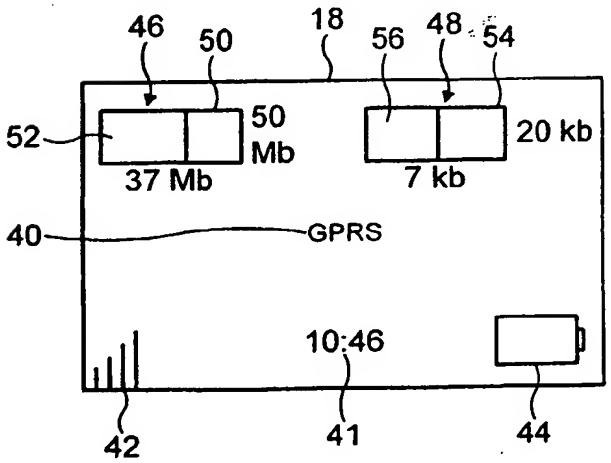

FIG. 3

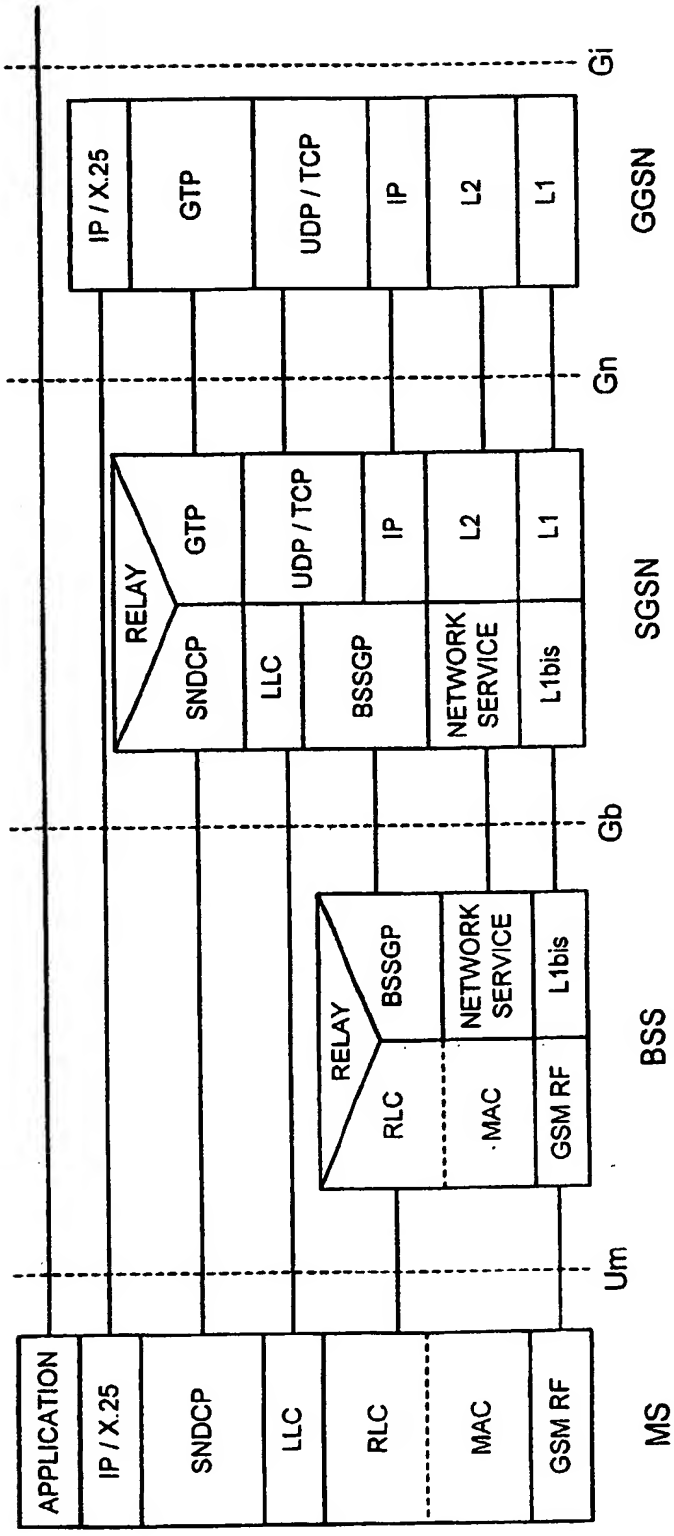
Gi
Gn
Gb
Um
GGSN
SGSN
BSS
MS
IP / X.25
GTP
UDP / TCP
IP
L2
L1
RELAY
SNDCP
LLC
BSSGP
NETWORK SERVICE
L1bis
RLC
MAC
GSM RF
APPLICATION

FIG. 4